

We claim:

1. An isolated nucleic acid molecule selected from the group consisting of:

a) an isolated nucleic acid molecule that encodes the amino acid sequence of a

5      *Drosophila* Odorant Receptor protein;

b) an isolated nucleic acid molecule that encodes a protein fragment of at least 6 amino acids of a *Drosophila* Odorant Receptor protein; and

c) an isolated nucleic acid molecule which hybridizes to a nucleic acid molecule comprising a nucleotide sequence encoding a *Drosophila* Odorant Receptor protein under conditions of sufficient stringency to produce a clear signal.

10      2. The isolated nucleic acid molecule of claim 1 wherein the nucleic acid comprises at least one exon-intron boundary located in a position selected from the group consisting of:

a) the nucleotides encoding the amino acids which comprise the third extracellular domain of a *Drosophila* Odorant Receptor protein;

b) the nucleotides encoding the amino acids which comprise the fourth extracellular domain of a *Drosophila* Odorant Receptor protein; and

c) the nucleotides encoding the amino acids which comprise the fourth intracellular domain of a *Drosophila* Odorant Receptor protein.

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3. The isolated nucleic acid molecule of claim 1, wherein the nucleic acid molecule is selected from the group consisting of SEQ ID NO: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 89, 91, 93, 95 and 97.

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4. The isolated nucleic acid molecule of any one of claims 1-3, wherein said nucleic acid molecule is operably linked to one or more expression control elements.

5. A vector comprising an isolated nucleic acid molecule of any one of claims 1-3.
6. A host cell transformed to contain the nucleic acid molecule of any one of claims 1-3.
7. A host cell comprising a vector of claim 5.
8. A host cell of claim 7, wherein said host is selected from the group consisting of prokaryotic hosts and eukaryotic hosts.

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9. A method for producing a protein or protein fragment comprising the step of culturing a host cell transformed with the nucleic acid molecule of any one of claims 1-3 under conditions in which the protein or protein fragment encoded by said nucleic acid molecule is expressed.

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10. The method of claim 9, wherein said host cell is selected from the group consisting of prokaryotic hosts and eukaryotic hosts.

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11. An isolated protein or protein fragment produced by the method of claim 10.
12. An isolated protein or protein fragment selected from the group consisting of:
  - a) an isolated protein comprising one of the amino acid sequences depicted in SEQ ID NO: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96 and 98;
  - b) an isolated protein fragment comprising at least 6 amino acids of any of the sequences depicted in SEQ ID NO: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96 and 98;

c) an isolated protein comprising conservative amino acid substitutions of any of the sequences depicted in SEQ ID NO: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96 and 98; and

5 d) naturally occurring amino acid sequence variants of any of the sequences depicted in SEQ ID NO: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96 and 98.

10 13. The isolated protein or protein fragment of claim 12 wherein the protein or protein fragment has at least one of the following conserved amino acids selected from the group consisting of:

- a) Leucine in the third extracellular domain of a *Drosophila* Odorant Receptor protein;
- b) Histidine in the third extracellular domain of a *Drosophila* Odorant Receptor protein;
- c) Cysteine in the sixth transmembrane domain of a *Drosophila* Odorant Receptor protein;
- d) Tryptophan in the fourth extracellular domain of a *Drosophila* Odorant Receptor protein;
- e) Glutamine in the seventh transmembrane domain of a *Drosophila* Odorant Receptor protein;
- f) Proline in the seventh transmembrane domain of a *Drosophila* Odorant Receptor protein;
- g) Alanine in the fourth intracellular domain of a *Drosophila* Odorant Receptor protein; and
- h) Tyrosine in the fourth intracellular domain of a *Drosophila* Odorant Receptor protein.

14. An isolated antibody that binds to a polypeptide of claim 11, 12 or 13.

15. The antibody of claim 14 wherein said antibody is a monoclonal or polyclonal antibody.

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16. A method of identifying an agent which modulates the expression of a protein or protein fragment of claim 11, 12 or 13 comprising the steps of:

- a) exposing cells which express the protein or protein fragment to the agent; and
- b) determining whether the agent modulates expression of said protein or protein

10 fragment, thereby identifying an agent which modulates the expression of a protein or protein fragment of claim 11, 12 or 13.

17. A method of identifying an agent which modulates the activity of a protein or protein fragment of claim 11, 12 or 13 comprising the steps of:

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- a) exposing cells which express the protein or protein fragment to the agent; and
  - b) determining whether the agent modulates the activity of said protein or protein fragment, thereby identifying an agent which modulates the activity of a protein or protein fragment of claim 11, 12 or 13.

20 18. The method of claim 17, wherein the agent modulates at least one activity of the protein or protein fragment.

19. A method of identifying an agent which modulates the transcription of the nucleic acid molecule of any one of claims 1-3 comprising the steps of:

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- a) exposing cells which transcribe the nucleic acid to the agent; and
  - b) determining whether the agent modulates transcription of said nucleic acid, thereby identifying an agent which modulates the transcription of the nucleic acid molecule of any one of claims 1-3.

20. A method of identifying binding partners for a protein or protein fragment of either claim 11, 12 or 13 comprising the steps of:

- a) exposing said protein or protein fragment to a potential binding partner; and
- b) determining if the potential binding partner binds to said protein or protein

5 fragment, thereby identifying binding partners for the protein or protein fragment.

21. A method of modulating the expression of a nucleic acid encoding a protein or protein fragment of claim 11, 12 or 13 comprising administering an effective amount of an agent which modulates the expression of a nucleic acid encoding the protein or protein

10 fragment.

22. A method of modulating at least one activity of a protein or protein fragment of claim 11, 12 or 13 comprising the step of administering an effective amount of an agent which modulates at least one activity of the protein or protein fragment.

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23. A method of identifying novel olfactory receptor genes comprising the steps of:

- a) selecting candidate olfactory receptor genes by screening a nucleic acid database using an algorithm trained to identify seven transmembrane receptors genes;
- b) screening said selected candidate olfactory receptor genes by identifying nucleic acid sequences with conserved amino acid residues and intron-exon boundaries common to olfactory receptors, and having open reading frames of sufficient size so as to encode a seven transmembrane receptor; and

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25 c) identifying the novel olfactory receptor genes and measuring the expression of olfactory receptor genes wherein the detection of expression confirms said candidate olfactory gene as an olfactory gene.

24. A method of identifying novel olfactory receptor genes comprising the steps of:

- a) selecting candidate olfactory receptor genes by screening a nucleic acid database for

nucleic acid sequences with sufficient homology to at least one known olfactory receptor gene;

- 5        b) screening said selected candidate olfactory receptor genes by identifying nucleic acids with conserved amino acid residues and intron-exon boundaries common to olfactory receptors, and having open reading frames of sufficient size so as to encode a seven transmembrane receptor; and
- c) identifying the novel olfactory receptor genes and measuring the expression of olfactory receptor genes wherein the detection of expression confirms said candidate olfactory gene as an olfactory gene.

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25. A transgenic insect modified to contain a nucleic acid molecule of any of claims 1-3.

15        26. The transgenic insect of claim 25, wherein the nucleic acid molecule contains a mutation that alters expression of the encoded protein.